

# Gender Effects on College Students' Academic Knowledge Awareness

## 大学生のアカデミックな知識認識に対する性別の影響

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**要旨：**学力の評価は、一般的に問題の正解あるいは不正解という採点方法により実施されてる。しかし、この評価方法では学生の真の理解度を把握することは不十分であり、また性別による違いがあるかどうかは不明である。本研究は、大学生を対象としてメタ認知モニタリング評価（Knowledge Monitoring Accuracy: KMA）を用いて学習認知能力の性差を調査した。KMA の評価は、1) [+ , +]: 理解しているということを理解している, 2) [- , -]: 理解していないということを理解している, 3) [+ , +] & [- , -]: 理解している及び理解していないということを理解しているに分類して、実際の学業成績と比較した。結果は男女間において学業成績及び各 KMA 評価に違いは見られなかった。しかし、[+ , +] には強い正の相関関係そして [- , -] には強い負の相関関係が示された ( $p < 0.01$ )。このことにより学習認知能力は性別の影響によるものではなく、学習者の理解能力そのものが学習成果に直結していることが確認された。

**Keywords :** Metacognition, Knowledge Monitoring Accuracy, Gender Effects, College Students

### Introduction

There is no doubt that paper tests traditionally evaluate students' academic knowledge at the majority of educational institutions. Although a variety of paper tests exist, typical question forms are commonly used: filled-in-the-blank, multiple-choice, and essay styles.<sup>1-4</sup> Those forms may seem an insufficient approach to recognize students' true academic knowledge because educators simply verify students' academic achievements as correct or incorrect answers. Learning with a confident awareness is critical for individuals and an essential of educational developments. Nevertheless, to my knowledge, none of any traditional paper tests clarify students' academic abilities with their confident awareness.

Nowadays, some educational institutions adopt 'metacognition' as an advanced teaching method. Metacognition is a series of process for individuals from setting to achieve their academic goals with

making, evaluating, developing plans themselves<sup>5</sup> (Figure 1) . A previous study shows that learners with high metacognitive ability demonstrate higher academic performance.<sup>6,8</sup>

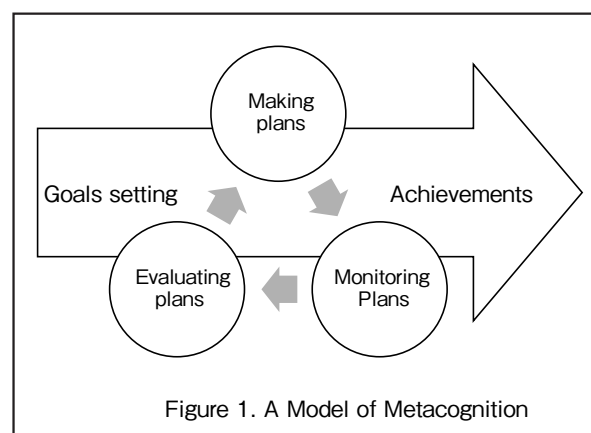


Figure 1. A Model of Metacognition

Knowledge Monitoring Assessment (KMA) is a measurement of metacognition by comparing between their estimated knowledge and actual task performance.<sup>6</sup> The KMA is extremely easy to apply and combine with traditional test forms. Following the instruction by Kusumoto *et al.*,<sup>9</sup> the KMA

exhibits four evaluation scores shown in Figure 2. A score  $[+,+]$  indicates that individuals' estimated answer is correct, and their actual answer is correct; a score  $[-,+]$  indicates that individuals' estimated answer is incorrect or unsure, but their actual answer is correct; a score  $[+,-]$  indicates that individual's estimated answer is correct, but their actual answer is incorrect; and a score  $[-,-]$  indicates that individual's estimated answer is incorrect or unsure, and their actual answer is incorrect. A score combining of  $[+,+]$  and  $[-,-]$  identifies students' valid academic performance with their accurate knowledge awareness. A number of researches report validities of the KMA measurement and positive correlations with students' academic achievements.<sup>6,9</sup>

Several researchers examined gender effects of academic knowledge on educational settings. The studies identify that women tend to demonstrate better academic performance than men in classrooms<sup>10,11</sup>; however, the other researchers suggest no gender differences existed in their academic grades.<sup>12,13</sup> Therefore, the purpose of this study was to determine whether any gender differences or correlations existed in an academic achievement with concerning of accurate knowledge awareness among college students.

## Methods

### Participants

Seventy-seven students (male:  $n = 44$ , age =  $19.1 \pm 1.2$  years; female:  $n = 33$ , age =  $18.5 \pm 0.8$  years) volunteered for this study. The subjects were recruited from a class, "Introduction to Athletic Training" in the 1st semester, 2007. This class was designed to learn basic information of Athletic Training such as athletic injuries preventions, recognitions, evaluations, immediate care, rehabilitation, and health care administrations. It includes Human Anatomy, Biomechanics, and Sports Nutrition as well. The subjects were all healthy and no academic disabilities presented at the time. Additionally, they were all first-year students. The Institutional Review Board of the college approved the protocol and procedure before the subjects involved this study.

### Procedures

#### Academic Test.

An academic test was provided as a final exam in the last week of the semester. The test consisted of 50 questions including 25 filled-in-the-blank and

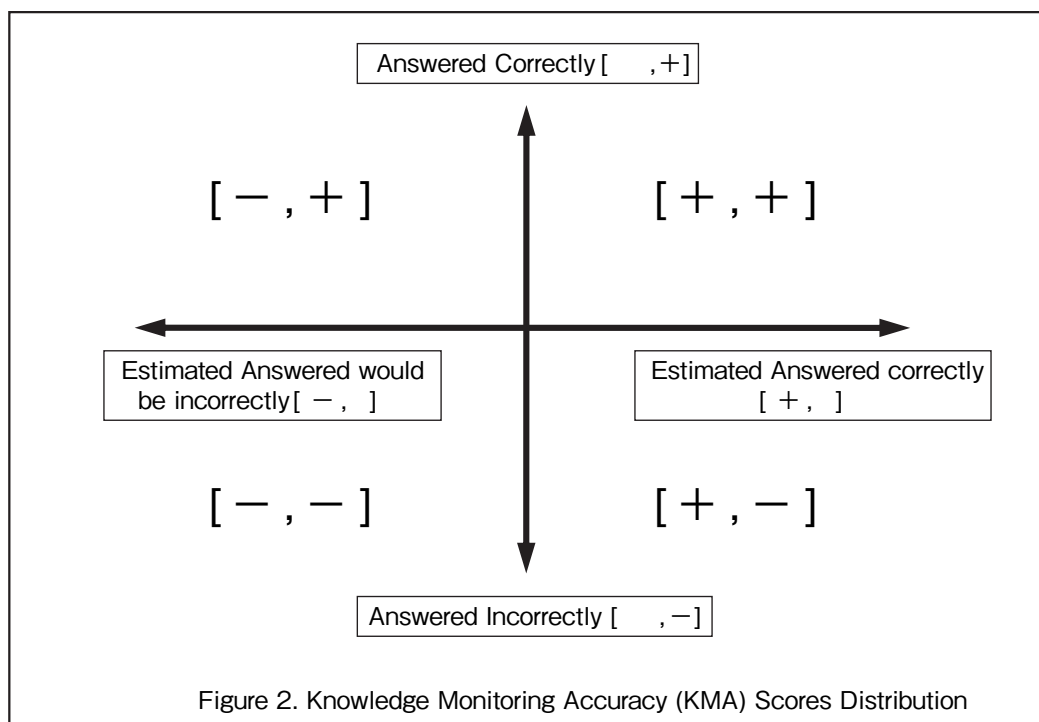


Figure 2. Knowledge Monitoring Accuracy (KMA) Scores Distribution

25 multiple-choice items. A multiple-choice item displayed 5 options per one question and only one correct answer existed. All questions were covered from the class lectures. Students were prohibited to use lecture notes and any other materials during the test. In addition, they required finishing the exam within 60 minutes. Scoring procedures were the same as a traditional method of grading. An instructor simply examined students' answers respectively as correct or incorrect items, and only correct items were counted for the purpose of this research. An individual's academic achievement was calculated by following formula:

$$\text{Academic achievement (score)} = \frac{\text{Sum of correct items}}{50} \times 100$$

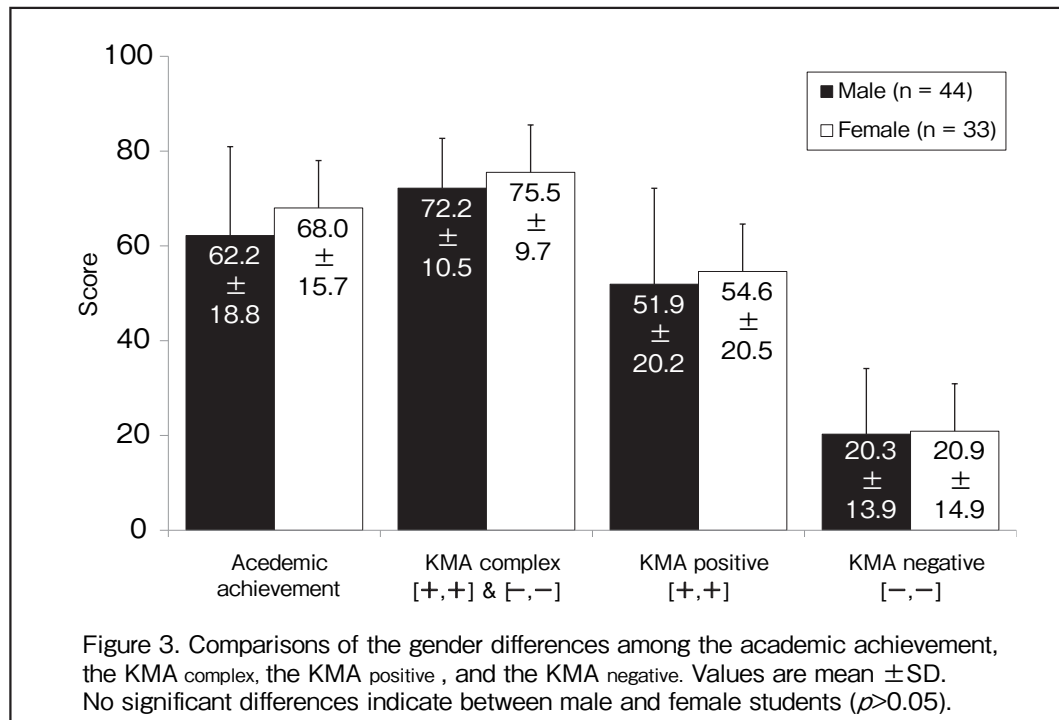
#### **Knowledge Monitoring Accuracy (KMA) .**

Knowledge monitoring accuracy (KMA) applied to measure students' accurate knowledge awareness. KMA items were displayed on the right side of each question in the academic test. Following instructions by Tobias and Everson,<sup>6,8</sup> the subjects were instructed to check either " + " or " - " on every questions. A " + " signified that students thought they would answer an item correctly. On

the other hand, a " - " signified that students thought they were unsure or they would be unable to answer an item correctly. The subjects were told that there was no right or wrong answers of KMA items and absolutely no effects on their academic grades.

While students completed the KMA items, they had answered the final exam at the same time. Immediately after the exam finished, an investigator evaluated KMA scores by followings: [ +, + ], [ -, - ], [ -, + ], and [ +, - ]. A score [ +, + ] represents KMA positive score that a student's estimated answer would be correct ( [ +, ] ) and an actual question answer was correct ( [ , + ] ) . A score [ -, - ] represents KMA negative score that a student's estimated would be incorrect [ -, ] and an actual question answer was incorrect [ , - ] . A combination of the positive and negative scores ( [ +, + ] & [ -, - ] ) is defined as an accurate knowledge monitoring ability, KMA complex score. On the other hand, a score [ -, + ] represents KMA incorrect 1 score that a student's estimated would be incorrect [ -, ] but an actual question answer was correct [ , + ] . Finally, a score [ +, - ] also represents KMA incorrect 2 score that a student's estimated answer would be correct [ +, ] but actual question answer was incorrect [ , - ] .

In this study, only the KMA complex, the



KMA positive, and the KMA negative were used to analysis each of the variables of interest. An individual' s KMA scores were calculated by following formula:

$$KMA_{\text{complex}} = \frac{\text{Sum of } ([+, +] \text{ and } [-, -])}{50} \times 100$$

$$KMA_{\text{positive}} = \frac{\text{Sum of } ([+, +])}{50} \times 100$$

$$KMA_{\text{negative}} = \frac{\text{Sum of } ([-, -])}{50} \times 100$$

### Statistical Analysis

All data were reported as mean  $\pm$  SD. A one-way ANOVA was used to compare among the academic achievement (test score) , the KMA complex, the

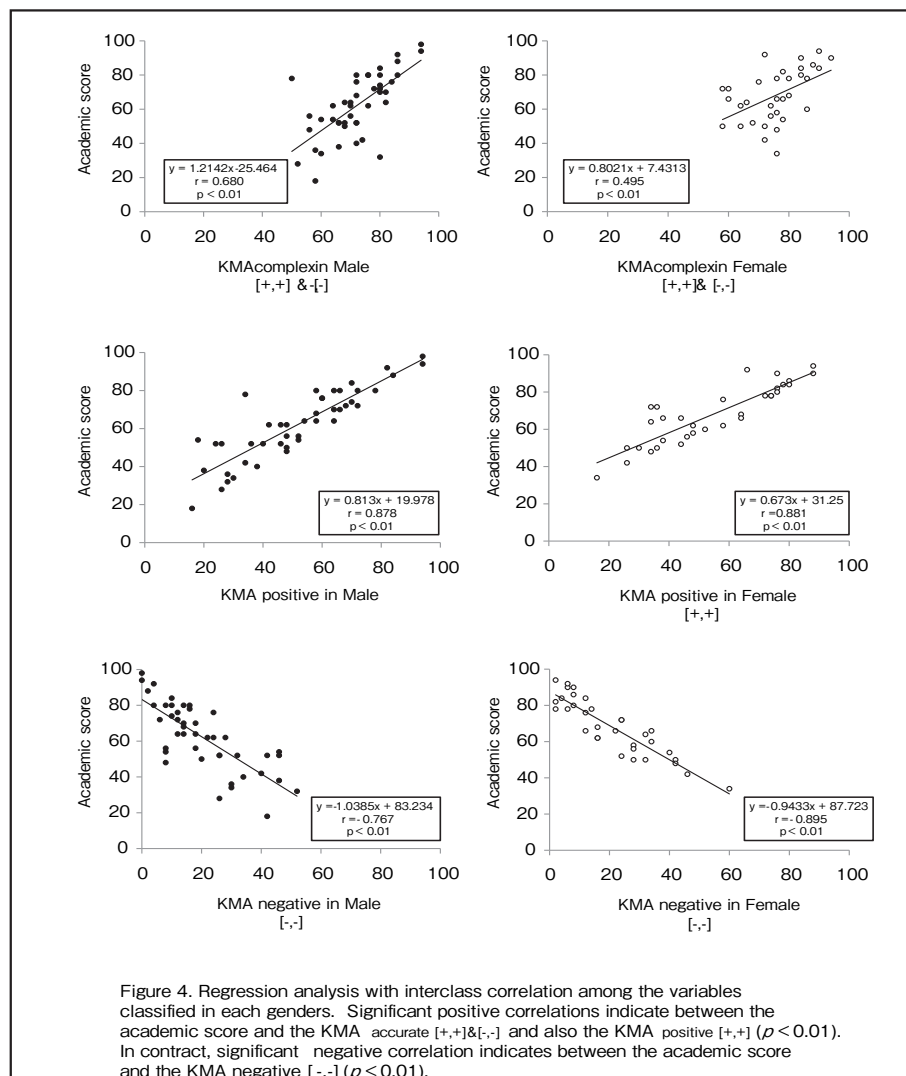
KMA positive, and the KMA negative between male and female students. Regression analysis with interclass correlation was also applied to the variables within the groups. Statistical analyses were performed using SPSS (version 16.0; SPSS Japan Inc, Tokyo, Japan) with the level of significance for all statistical tests set a priori at  $p < 0.05$ .

### Results

No significant differences were reported among the variables between male and female students shown in Figure 3 ( $p > 0.05$ ) .

Significant positive correlations were reported between the academic test score and the KMA complex and between academic test score and the KMA positive in the different gender groups shown in Figure 4. ( $p < 0.01$ )

Significant negative correlation was reported



between the academic test score and the KMA negative in the different gender groups shown in Figure 4. ( $p < 0.01$ )

### Discussion

This study indicates that the KMA complex score is significantly related to students' academic achievements for both gender groups ( $r = 0.680$  and  $r = 0.495$ ,  $p < 0.01$  for male and female, respectively). In particular, students with higher KMA positive score demonstrate better academic performance ( $r = 0.878$  and  $r = 0.881$ ,  $p < 0.01$  for male and female, respectively). Conversely, students with highly scored KMA negative demonstrate lower academic performance ( $r = -0.767$  and  $r = -0.895$ ,  $p < 0.01$  for male and female, respectively). However, this study reveals no gender differences existed among the academic achievement and the accurate KMA scores. Therefore, no matter what genders are, the KMA can be valid to recognize students' real academic performance and current knowledge awareness.

The KMA classify an academic score by independent four categories:  $[+, +]$ ,  $[-, -]$ ,  $[-, +]$ , and  $[+, -]$ . The KMA is not only an evaluation instrument for individuals' confident academic achievements but also it provides practical feedbacks for educators as a newly-established teaching method. Traditional scoring methods dose not solve students' essential problems why they lead answers incorrectly. Through the KMA classifications; however, incorrect answers can be explained by possible two KMA scores:  $[-, -]$  and  $[+, -]$ . For instance, the score of  $[-, -]$  identifies that students do not understand anything on the incorrect answers. On the other hand, the score of  $[+, -]$  detects that students overestimate or misunderstand on the incorrect answers. Likewise, the scores of  $[+, +]$  and  $[-, +]$  describe individuals' correct answers with possible two explanations. The score of  $[+, +]$  identifies individuals' learning completion on the correct answers. On the other side, the score of  $[-, +]$  detects that students underestimate or just answer luckily on the

correct answers. Thus, the KMA can investigate individuals' academic accomplishments in details.

### Conclusions

Knowledge Monitoring Assessment (KMA) is a practical instrument to examine students' true academic performance.<sup>6-9</sup> Although there are no differences existed between male and female students, the KMA evaluation scores still identify students' learning awareness appropriately. This study reveals that students' with higher KMA positive ( $[+, +]$ ) positively relates to better academic achievement, yet students' with higher KMA negative ( $[-, -]$ ) negatively relates to lower academic achievement in educational situations.

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